

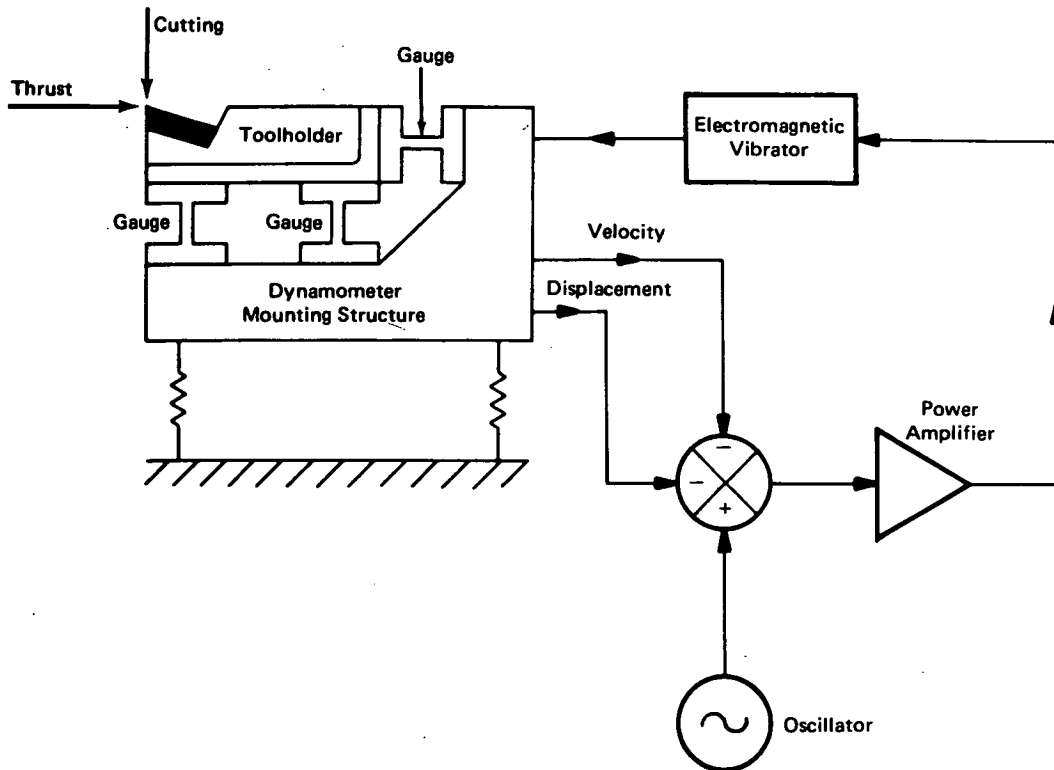
NASA TECH BRIEF

Marshall Space Flight Center



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Dynamometer for Measuring Machining Forces in Two Perpendicular Directions



Schematic of Basic Dynamometer

The speed of present metal-cutting machines is limited by self-excited vibration. This vibration, commonly known as chatter, occurs at high cutting speeds because of a dynamic interaction between the metal workpiece and the machine tool structure. It causes increased tool wear, dimensional inaccuracies, poor surface finish, and can be extremely noisy.

A report has been published which discusses the development of a two-component force dynamometer. The dynamometer is to be used for the dynamic measurement of the machining forces in the cutting and thrust directions. From the resulting data, faster metal-

cutting machines may be developed that have reduced vibrations.

The dynamometer structure is a part of the basic tool control system as shown in the illustration. The dynamometer itself includes a mounting structure, a toolholder, and a set of gauges. The horizontally positioned strain gauges are used for measuring the thrust force, and the vertically positioned gauges are for measuring the cutting force. The toolholder is used for supporting the workpiece perpendicularly to the turning axis of the machine tool.

(continued overleaf)

The dynamometer is vibrated in the thrust direction by an electromagnetic vibrator. This simulates the thrust vibrations encountered in the actual machining process. The vibration signals are provided by a sinusoidal oscillator. The oscillator signals are summed with the velocity and displacement signals from the dynamometer. They are then amplified and fed to the electromagnetic vibrator. This feedback arrangement provides a stable vibrational force to the dynamometer.

Notes:

1. The developed dynamometer may be of interest to manufacturers of high-speed machine cutting tools.
2. Requests for further information may be directed to:
Technology Utilization Officer
Marshall Space Flight Center
Code AT01
Marshall Space Flight Center, Alabama 35812
Reference: B74-10148

Patent status:

NASA has decided not to apply for a patent.

Source: I. A. Sutherland
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